

$\Sigma(1580) \ 3/2^-$ $I(J^P) = 1(\frac{3}{2}^-)$ Status: *

OMITTED FROM SUMMARY TABLE

Seen in the isospin-1 $\bar{K}N$ cross section at BNL (LI 73, CARROLL 76) and in a partial-wave analysis of $K^- p \rightarrow \Lambda\pi^0$ for c.m. energies 1560–1600 MeV by LITCHFIELD 74. LITCHFIELD 74 finds $J^P = 3/2^-$. Not seen by ENGLER 78 or by CAMERON 78C (with larger statistics in $K_L^0 p \rightarrow \Lambda\pi^+$ and $\Sigma^0\pi^+$).

Neither OLMSTED 04 (in $K^- p \rightarrow \Lambda\pi^0$) nor PRAKHOV 04 (in $K^- p \rightarrow \Lambda\pi^0\pi^0$) see any evidence for this state.

 $\Sigma(1580)$ POLE POSITION

REAL PART

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
1607^{+13}_{-11}	¹ KAMANO	15	DPWA Multichannel

¹ From the preferred solution A in KAMANO 15. Solution B reports $M = 1492^{+4}_{-7}$ MeV.

–2×IMAGINARY PART

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
253^{+30}_{-18}	² KAMANO	15	DPWA Multichannel

² From the preferred solution A in KAMANO 15. Solution B reports $M = 138^{+8}_{-14}$ MeV.

 $\Sigma(1580)$ POLE RESIDUES

The normalized residue is the residue divided by $\Gamma_{pole}/2$.

Normalized residue in $N\bar{K} \rightarrow \Sigma(1580) \rightarrow N\bar{K}$

MODULUS	PHASE (°)	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.00778	51	³ KAMANO	15	DPWA Multichannel

³ From the preferred solution A in KAMANO 15.

Normalized residue in $N\bar{K} \rightarrow \Sigma(1580) \rightarrow \Sigma\pi$

MODULUS	PHASE (°)	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.0625	–6	⁴ KAMANO	15	DPWA Multichannel

⁴ From the preferred solution A in KAMANO 15.

Normalized residue in $N\bar{K} \rightarrow \Sigma(1580) \rightarrow \Lambda\pi$

<u>MODULUS</u>	<u>PHASE (°)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
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• • • We do not use the following data for averages, fits, limits, etc. • • •

0.059	156	⁵ KAMANO	15	DPWA Multichannel
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⁵ From the preferred solution A in KAMANO 15.

Normalized residue in $N\bar{K} \rightarrow \Sigma(1580) \rightarrow \Sigma(1385)\pi$, S-wave

<u>MODULUS</u>	<u>PHASE (°)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
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• • • We do not use the following data for averages, fits, limits, etc. • • •

0.0368	-18	⁶ KAMANO	15	DPWA Multichannel
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⁶ From the preferred solution A in KAMANO 15.

Normalized residue in $N\bar{K} \rightarrow \Sigma(1580) \rightarrow \Sigma(1385)\pi$, D-wave

<u>MODULUS</u>	<u>PHASE (°)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
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• • • We do not use the following data for averages, fits, limits, etc. • • •

0.0103	123	⁷ KAMANO	15	DPWA Multichannel
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⁷ From the preferred solution A in KAMANO 15.

 $\Sigma(1580)$ MASS

<u>VALUE (MeV)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
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 ≈ 1580 OUR ESTIMATE

1583 ± 4	⁸ CARROLL	76	DPWA Isospin-1 total σ
1582 ± 4	⁹ LITCHFIELD	74	DPWA $K^- p \rightarrow \Lambda\pi^0$

⁸ CARROLL 76 sees a total-cross-section bump with $(J+1/2) \Gamma_{el} / \Gamma_{total} = 0.06$.

⁹ The main effect observed by LITCHFIELD 74 is in the $\Lambda\pi$ final state; the $\bar{K}N$ and $\Sigma\pi$ couplings are estimated from a multichannel fit including total-cross-section data of LI 73.

 $\Sigma(1580)$ WIDTH

<u>VALUE (MeV)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
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15	¹⁰ CARROLL	76	DPWA Isospin-1 total σ
11 ± 4	¹¹ LITCHFIELD	74	DPWA $K^- p \rightarrow \Lambda\pi^0$

¹⁰ CARROLL 76 sees a total-cross-section bump with $(J+1/2) \Gamma_{el} / \Gamma_{total} = 0.06$.

¹¹ The main effect observed by LITCHFIELD 74 is in the $\Lambda\pi$ final state; the $\bar{K}N$ and $\Sigma\pi$ couplings are estimated from a multichannel fit including total-cross-section data of LI 73.

$\Sigma(1580)$ DECAY MODES

	Mode
Γ_1	$N\bar{K}$
Γ_2	$\Lambda\pi$
Γ_3	$\Sigma\pi$
Γ_4	$\Sigma(1385)\pi$, S-wave
Γ_5	$\Sigma(1385)\pi$, D-wave
Γ_6	$N\bar{K}^*(892)$, S=1/2, D-wave
Γ_7	$N\bar{K}^*(892)$, S=3/2, S-wave
Γ_8	$N\bar{K}^*(892)$, S=3/2, D-wave

 $\Sigma(1580)$ BRANCHING RATIOS

See "Sign conventions for resonance couplings" in the Note on Λ and Σ Resonances.

 $\Gamma(N\bar{K})/\Gamma_{\text{total}}$ Γ_1/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
+0.03 ± 0.01	¹² LITCHFIELD 74	DPWA	$\bar{K}N$ multichannel

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.003 ¹³ KAMANO 15 DPWA Multichannel

¹² The main effect observed by LITCHFIELD 74 is in the $\Lambda\pi$ final state; the $\bar{K}N$ and $\Sigma\pi$ couplings are estimated from a multichannel fit including total-cross-section data of LI 73.

¹³ From the preferred solution A in KAMANO 15.

 $\Gamma(\Lambda\pi)/\Gamma_{\text{total}}$ Γ_2/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
0.490	¹⁴ KAMANO	15	DPWA Multichannel

¹⁴ From the preferred solution A in KAMANO 15.

 $\Gamma(\Sigma\pi)/\Gamma_{\text{total}}$ Γ_3/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
0.387	¹⁵ KAMANO	15	DPWA Multichannel

¹⁵ From the preferred solution A in KAMANO 15.

 $\Gamma(\Sigma(1385)\pi, \text{S-wave})/\Gamma_{\text{total}}$ Γ_4/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
0.12	¹⁶ KAMANO	15	DPWA Multichannel

¹⁶ From the preferred solution A in KAMANO 15.

$\Gamma(\Sigma(1385)\pi, D\text{-wave})/\Gamma_{\text{total}}$ Γ_5/Γ

<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
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• • • We do not use the following data for averages, fits, limits, etc. • • •

0.001	¹⁷ KAMANO	15	DPWA Multichannel
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¹⁷ From the preferred solution A in KAMANO 15.

$\Gamma(N\bar{K}^*(892), S=1/2, D\text{-wave})/\Gamma_{\text{total}}$ Γ_6/Γ

<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
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• • • We do not use the following data for averages, fits, limits, etc. • • •

not seen	¹⁸ KAMANO	15	DPWA Multichannel
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¹⁸ From the preferred solution A in KAMANO 15.

$\Gamma(N\bar{K}^*(892), S=3/2, S\text{-wave})/\Gamma_{\text{total}}$ Γ_7/Γ

<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
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• • • We do not use the following data for averages, fits, limits, etc. • • •

not seen	¹⁹ KAMANO	15	DPWA Multichannel
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¹⁹ From the preferred solution A in KAMANO 15.

$\Gamma(N\bar{K}^*(892), S=3/2, D\text{-wave})/\Gamma_{\text{total}}$ Γ_8/Γ

<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
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• • • We do not use the following data for averages, fits, limits, etc. • • •

not seen	²⁰ KAMANO	15	DPWA Multichannel
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²⁰ From the preferred solution A in KAMANO 15.

$(\Gamma_i\Gamma_f)^{1/2}/\Gamma_{\text{total}}$ in $N\bar{K} \rightarrow \Sigma(1580) \rightarrow \Lambda\pi$ $(\Gamma_1\Gamma_2)^{1/2}/\Gamma$

<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
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not seen	CAMERON	78C	HBC $K^0_p \rightarrow \Lambda\pi^+$
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not seen	ENGLER	78	HBC $K^0_L \rightarrow \Lambda\pi^+$
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+0.10±0.02	²¹ LITCHFIELD	74	DPWA $K^-_p \rightarrow \Lambda\pi^0$
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²¹ The main effect observed by LITCHFIELD 74 is in the $\Lambda\pi$ final state; the $\bar{K}N$ and $\Sigma\pi$ couplings are estimated from a multichannel fit including total-cross-section data of LI 73.

$(\Gamma_i\Gamma_f)^{1/2}/\Gamma_{\text{total}}$ in $N\bar{K} \rightarrow \Sigma(1580) \rightarrow \Sigma\pi$ $(\Gamma_1\Gamma_3)^{1/2}/\Gamma$

<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
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not seen	CAMERON	78C	HBC $K^0_p \rightarrow \Sigma^0\pi^+$
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not seen	ENGLER	78	HBC $K^0_L \rightarrow \Sigma^0\pi^+$
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+0.03±0.04	²² LITCHFIELD	74	DPWA $\bar{K}N$ multichannel
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²² The main effect observed by LITCHFIELD 74 is in the $\Lambda\pi$ final state; the $\bar{K}N$ and $\Sigma\pi$ couplings are estimated from a multichannel fit including total-cross-section data of LI 73.

$\Sigma(1580)$ REFERENCES

KAMANO	15	PR C92 025205	H. Kamano <i>et al.</i>	(ANL, OSAK)
OLMSTED	04	PL B588 29	J. Olmsted <i>et al.</i>	(BNL Crystal Ball Collab.)
PRAKHOV	04	PR C69 042202	S. Prakhov <i>et al.</i>	(BNL Crystal Ball Collab.)
CAMERON	78C	NP B132 189	W. Cameron <i>et al.</i>	(BGNA, EDIN, GLAS+) I
ENGLER	78	PR D18 3061	A. Engler <i>et al.</i>	(CMU, ANL)
CARROLL	76	PRL 37 806	A.S. Carroll <i>et al.</i>	(BNL) I
LITCHFIELD	74	PL 51B 509	P.J. Litchfield	(CERN) IJP
LI	73	Purdue Conf. 283	K.K. Li	(BNL) I
